THE SELF-REPORTED CONFIDENCE AND PROFICIENCY LEVELS IN COMMUNICATION SKILLS: A COMPARISON OF UNDERGRADUATE STUDENTS IN A TECHNICAL COMMUNICATION COURSE AND SENIOR CAPSTONE STUDENTS

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Abstract – One study of American college students found that students generally rate such attributes as public speaking and writing (along with academic ability in general) as above average [6]. So we wanted to see if our engineering students felt the same. To do so, we conducted our study over two phases and over multiple years. The second phase grew out of an earlier one, phase one, conducted between the winter term, 2013 and the winter term, 2016. In the first phase, we administered a survey that asked 2nd year technical communication students to self-report on their levels of proficiency and confidence in their communication skills – writing, speaking, teamwork and personal skills development (or lifelong learning) [2][5]. In all, 370 students completed the survey.

This survey, administered at the beginning and toward the end of the course, asked 20 questions related to communication tasks that we routinely ask them to do as part of the course, such as writing documents of >5 pages or <5 pages, or giving a speech to groups of >20 or <20 people. The survey, which took about 10 minutes to complete, was completely anonymous so that students could not be matched to grades nor could we determine why a student responded in a particular way. This earlier study found that students felt they had a moderate level of confidence in their communication skills, but they also believed that the expected level of proficiency in their senior year would be substantially higher than their current levels; that is, whereas they believed these current levels were, on average, 3 on the CDIO scale of 5, they believed the expected proficiency levels would be 4.5 on average.

We were then curious to see how students in the senior (capstone) design courses would respond to the same survey. Once again, the survey was anonymous and could not be matched to a particular student. Our goal in surveying capstone students was to see whether they still felt at least moderately confident in their communication skills (for the most part, they do) and whether they now feel more proficient in communicating the information that supports the engineering work done in the course. Our expectation was that this cohort of senior capstone students would feel more proficient and confident than their younger selves.

Keywords: technical communication, lifelong learning, confidence levels, team work

1. INTRODUCTION

If confidence reflects a belief in one’s own ability to do a task, and if proficiency reflects a level of achievement or competence, then the first survey we conducted in a 2nd year technical communication class suggests that students do have at least some measure of confidence in their communication skills. In terms of proficiency, however, they believe they have a long way to go. Our goal in surveying capstone students was to see whether they still felt confident in their communication skills (for the most part, they do) and whether they now feel more proficient in communicating their engineering work. For the senior Mechanical Engineering students, for example, their levels of confidence have increased but for the Electrical and Computer Engineering capstone students, they are less sure.

After receiving approval from the capstone coordinators, we administered the survey to the Mechanical Engineering capstone design class in November, 2017, to the Electrical and Computer Engineering capstone design class in January, 2018 and to the Civil Engineering capstone design class in March, 2018.

The results proved interesting. For example, in the survey of the Mechanical Engineering capstone students, their current self-reported proficiency levels were 3.8 on a scale of 5, on average. The newly reported proficiency levels were a marked improvement over the responses from the 2nd year students, who ranked their proficiency as 3, on average, on a scale of 5. These 2nd year students indicated they would have to achieve a level of 4.5, on a scale of 5, by graduation. The capstone students, for the most part, indicated they had not achieved that goal. Questions about the Mechanical Engineering students’ current levels of proficiency in the area of speaking showed the largest overall gain between
the two surveys (0.45 points), even though this category contained the three lowest-scoring questions, while the lifelong learning questions improved by 0.35 points, a signal possibly of personal growth. In both surveys, questions regarding teamwork received the highest scores.

2. THE SURVEY

We asked students to respond by using a scale developed by CDIO, an international group dedicated to curriculum planning and assessment in Engineering [1].

Levels of proficiency (based on CDIO levels, 2008):
1. to have experience or been exposed to
2. to be able to participate in and contribute to
3. to be able to understand and explain
4. to be skilled in the practice or implementation of
5. to be able to lead or innovate in

The survey consists of 20 questions, and is divided into four areas related to the types of communication skills targeted in both the technical communication class and the senior design class: writing, speaking, teamwork and lifelong learning. Interestingly, for the Mechanical Engineering and for the Electrical and Computer Engineering students, the areas that ranked more highly were questions 12 and 19 (related to teamwork and lifelong learning) while questions 4 (writing), 6, 8 and 10 (speaking) were in the bottom.

2.1. Phase 1: ENG 2010

The first phase of this study, administered to students near the beginning of their undergraduate degrees, included approximately 450 students in nine class sections over seven consecutive semesters from January 2013 to April 2015. This was accomplished in ENG 2010, which is typically taken by students in their second year. This is the first mandatory technical writing course for all students in the Civil, Electrical & Computer, and Mechanical Engineering departments.

Students in the ENG 2010 course completed the survey twice, once at the beginning of the semester and again at the end. In both surveys the students were asked to rate their confidence in a number of communication tasks. In the second survey the students were additionally asked to speculate on how proficient they would need to be in the same tasks when they graduate.

2.2. Phase 2: Capstone

The second phase of this study was to repeat the survey with students near the end of their undergraduate degrees. To do this, the survey was administered to students in their department-specific capstone design courses, which are typically taken in their final year of study.

A total of 183 students participated in the second phase (46 Civil, 55 Electrical & Computer, and 82 Mechanical), which represents 70% of the students enrolled in these classes. Not all students were present in class the day that the survey was administered, and some students who were present elected to return the surveys unanswered. The surveys were conducted from November 2017 to March 2018.

3. RESULTS

Since all survey answers were submitted anonymously, the responses were averaged to produce a snapshot of the overall confidence level of each communication area for every cohort. As shown in Table 1, the average confidence level in each communication area increased from the first ENG 2010 survey at the beginning of the semester to the second ENG 2010 survey at the end of the semester. Average confidence levels increased again by the final capstone survey. The largest gain in average confidence levels from ENG 2010 to capstone was made in the speaking category (+0.35), while the smallest gain was in the teamwork category (+0.03).

Table 1: Average survey responses.

<table>
<thead>
<tr>
<th></th>
<th>ENG 2010: Survey 1</th>
<th>ENG 2010: Survey 2</th>
<th>Capstone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing</td>
<td>3.11</td>
<td>3.43</td>
<td>3.60</td>
</tr>
<tr>
<td>Speaking</td>
<td>2.89</td>
<td>3.17</td>
<td>3.52</td>
</tr>
<tr>
<td>Teamwork</td>
<td>3.62</td>
<td>3.67</td>
<td>3.70</td>
</tr>
<tr>
<td>Lifelong Learning</td>
<td>3.40</td>
<td>3.52</td>
<td>3.69</td>
</tr>
</tbody>
</table>

Across all of the surveys, on average, students reported lower confidence levels for tasks in the writing and speaking categories, and higher confidence levels for tasks in the teamwork and lifelong learning categories.

3.1. Responses by Engineering Department

For the capstone survey, the responses were also averaged by communication area across each department. In Fig. 1, the capstone survey responses are separated by department, and shown alongside the average responses from the ENG 2010 surveys. The expected proficiency levels at graduation, from the second ENG 2010 survey, are also given in Figure 1.
When the capstone survey responses are separated by department, certain differences emerge. Students in the Mechanical Engineering department reported the highest confidence levels in all areas except oral communication, whereas the Civil Engineering department reported higher levels in that area. Average confidence levels from the Electrical & Computer Engineering department were the lowest amongst their capstone peers, and were either lower than, or equal to, the responses from the second ENG 2010 survey.

However, none of the average responses from any of the departments in the capstone survey came close to meeting the optimistic expectations that the ENG 2010 students had for their communication skills in their final undergraduate year.

### 3.2. Highest and Lowest Responses

Across all of the Engineering departments in the capstone survey, students felt particularly confident or less confident in certain communication tasks. The task the students reported the highest levels of confidence (4.1) in was “working as a member of a small team (≤ 5 people).” In contrast, the task that received the lowest average confidence score (3.3) from students was “giving a speech in front a large group (> 20 people).” These results reflect the overall trend across all of the surveys of higher confidence levels in teamwork tasks, and lower confidence levels in speaking tasks.

In the capstone survey, student responses for most tasks reflected the full range of the CDIO scale (1-5). However, in the Civil Engineering cohort, two of the tasks did not receive a score below 3 from any student. These tasks were:

- “writing shorter documents (<5 pages) for readers with an engineering background (minimum 1-2 years in an engineering program),” and
- “giving a speech to people you do know.”

Interestingly, these two tasks are from the areas of writing and speaking, categories in which the confidence levels scores were lower on average. In the same cohort, eleven other tasks did not receive a score below a 2 from any student.

Similarly, in the Mechanical Engineering cohort no student responded below a 3 to:

- “continuing to learn and expand your knowledge after you complete your B.Sc. in Engineering,” and
- “applying critical inquiry and analysis to engineering problems and doing the communications that support the engineering work.”

Both of these tasks were grouped in the lifelong learning category. Students from Mechanical Engineering gave scores of only 2 or above to an additional five tasks on the survey.

### 4. DISCUSSION

It is unsurprising, although still reassuring, that undergraduate Engineering student confidence levels in communication tasks assessed in this survey increased overall from their second year to their final year. The largest gains were seen in the areas of written and oral communication, in part because these were the areas of least confidence in the second-year ENG 2010 survey. By their final undergraduate year, students felt nearly as confident with writing and speaking as they did with the traditionally stronger areas of teamwork and lifelong learning.

In this study, average confidence levels of students in capstone courses differed significantly depending on their department. Part of this discrepancy may be attributed to differences in the way each department runs its capstone course and the different emphasis and goals in each. Mechanical Engineering students complete a single-semester capstone course in the Fall term, with small teams (4-6 students) and strong support from Engineers-in-Residence. The Electrical & Computer Engineering capstone course spans two consecutive semesters and also has small teams of 4-6 students. Civil Engineering
students complete their capstone course over one semester in winter term and typically in large teams of variable size.

Additionally, some students’ choosing not to participate, or not being present in class the day that the surveys were administered, may influence the survey results. Of the three capstone courses, attendance was only mandatory in the Mechanical Engineering department. This department also reported the highest confidence levels on average in three of the four categories. In contrast, while the Electrical & Computer Engineering department consistently reported the lowest confidence levels on average, only 59% of the class returned the surveys in part or completely.

Ultimately, it is up to each department to decide if students are performing adequately in each communication area. However, this study can serve as a tool for the departments and course coordinators to assess whether or not students in their courses are achieving the desired levels of confidence in these communication tasks.

5. CONCLUDING REMARKS

It is well known, as researchers like Seth and Carryon suggest, that confidence in one’s ability to complete a task effectively is linked to academic success [4]. Knowing students’ confidence levels in their communication skills, as discussed here, may help educators to understand the relationships between course design and the development of communication skills in their students. Knowing where student felt less confident can thereby help educators see what needs to be taught more strategically or emphasized more in a course.

In these terms, the higher reported confidence levels in writing for the ME students (3.74) connects to another study [3] we did where we examined (among other things) the frequency of writing that students did in each year of their program. The ME students, we found, did more writing than the other departments, and this may account for their increased levels of confidence.

All in all, these surveys are suggestive in that we see how students’ perceptions of their communication skills change from moderate to higher proficiency levels as they move forward. However, the levels of the ECE Capstone students, while higher than those of the 2nd year students, were nevertheless only moderately higher and in some instances were actually lower. One would have expected this cohort of senior students to feel more confident and proficient than their younger selves, but these results may point to a need for an even greater emphasis on communication skills throughout a program. For an undergraduate, that confidence can translate into improved academic performance but, for the graduating students, that confidence can lead to professional success.

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References


